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ABSTRACT

The computer-mediated communication (CMC) learning environment focuses on children's interaction with the computers and their mastery of the technology as potential for learning. Peer interaction mainly in cooperative and collaborative learning environments (CL) focus on the contribution of peers to literacy and writing development. A study examined writing development and perception about writing of Arab and Jewish elementary school children in Israel within each of the above learning environments and within an integrated method of CL-CMC. Each of the three methods was carefully designed and implemented based on the theoretical model of the six "mirrors" of the classroom (Hertz-Lazarowitz, 1992). The central research question was to find the differential contribution of each of these learning environments in children's writing development. Research was conducted within 20 fifth and sixth grade classrooms in six schools, three Arab and three Jewish. Data were collected from 599 students (210 Jewish, 389 Arab) twice in the school year, and multivariate repeated measures analysis was conducted on this data. The CL-CMC learning environment created the larger gains with time in scores for the students. In the CL only, the scores decreased slightly; in the CMC no gains were found in all of the measures. The important finding is that CL-CMC equalized and enriched significantly Arabs and girls groups which usually gain less. In addition, the contribution of CL-CMC to the affective domains of children's writing is prominent. (Contains 4 tables, 5 figures, and 58 references.) (NKA)

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Measures of Writing Development in Learning Environments Using Cooperative Learning (CL) and Computer Mediated Communication (CMC).

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Introduction: The classroom of the future

In the classroom of the future children will interact with their teachers, with their peers and with computers (Almog & Hertz-Lazarowitz, 1999). Literacy will include in addition to reading, extensive written composition and communication. Most classrooms in the western world enter the world of literacy and computer in two main directions. One is with a great focus on computer literacy and the other with increased emphasis on writing as an interactive - developmental process. The computer based learning environment focuses on children's interaction with the computers and their mastery of the technology as potential for learning. Peer interaction mainly in cooperative and collaborative learning environments focus on the contribution of peers to literacy and writing development. Unfortunately in most classrooms, these two learning contexts do not integrate.

Creating three learning environments: CL, CMC, and Integrated CL-CMC

In this study writing development and perception about writing of Arab and Jewish elementary school children in Israel was examined within each of the above learning environments (LE). The first included children who studied in Cooperative Learning (CL), in the ALASH method, the Hebrew initials for an integrated cooperative language arts method (CL). The second included children who studied writing via Computer Mediated Communication (CMC) and the third included children who studied in an integrated method of CL-CMC. Each of the three methods was carefully designed and implemented based on the theoretical model of the six mirrors of the classroom (Hertz-Lazarowitz, 1992) described in the following section.

The central research question was to find the differential contribution of each of the above learning environments to children's writing development. Gains were defined on psychological measures related to the writing process such as; students' self-evaluation of writing, Writing Apprehension, Writing Self-Efficacy, Self-Regulatory Efficacy for Writing, Writing with computer and working on Computer Network. It was hypothesized that time (pre-post in one school year) and

type of learning environments will significantly affect students' perception about writing. In addition to attitudinal measures, final school grade in Language Arts, teachers' evaluation of students and samples of writing in portfolios were assessed. Since the integrated CL-CMC environment combines the "best of two worlds" we predicted that in this LE maximum gains would be achieved. Students learning either in CL or in CMC will have intermediate effects of gains. An open question remained as to the superiority of one LE over the other.

The students in this study Arabs and Jews were not studied extensively before. Prior research in Israel, using ALASH showed that Jews gained more than Arabs in Language Arts test scores and in writing (Hertz-Lazarowitz & Schaedel, 1997; Kerlitz-Nisim, 1998). Boys gained more than girls in writing with computers (Bar-Natan, 1996; see also Matzko, 1996; Volman, 1997), but in writing girls outscored boys in CL classrooms (Hertz-Lazarowitz, Schaedel & Lerner, 1996).

The Six Mirrors of the Classroom

No one can say how exactly the future classroom will look and function, and therefore planning of schools and classrooms for the future is in initial stages (Almog & Hertz-Lazarowitz, 1999). It is clear, however, that changes in any dimension of classroom activity will interact with other dimensions/mirrors in the classroom (Hertz-Lazarowitz, 1992). The development of micro-technology made attainable what was once merely a dream, the use of the computer as a personal tool much like notebook and pen (Hiltz, 1994; Linstone, 1994). Every new technological development will change at least some basic features in the learning environment and require re-adjustment and changes. Hertz-Lazarowitz (1992) proposed a model of the classroom that takes into account the richness and complexity of the classroom environment and the intricacies of the interactions between many variables in the classroom. This model consisted of six "mirrors", a term chosen to portray the view that the dimensions that characterize the classroom are interrelated and reflected in one another: structure and activities in one dimension have implications for what is

possible in another dimension. For example, if the teacher maintains central control of the classroom (the "mirror" of teacher's instruction), this will be reflected in students' behavior. The students will be unable to engage in multilateral investigation (the "mirror" of students' academic behavior).

Technological development, if utilized correctly, has the potential to eventually revolutionize the classroom. However this revolution has to be within an integrative understanding of the interdependence of the different mirrors. Thus every future learning/teaching environment has to be sensitive to the design of (1) the physical setting and organization; (2) the structure of the learning task; (3-4) the instructional and communicational behaviors of the teacher; and (5-6) the academic and social communication and behaviors of the student. These mirrors are interrelated in a systematic way, and cannot be separated when functioning, observing or studying the learning environment (Hertz-Lazarowitz, 1992). The three learning environments in the present study were designed following the mirrors' model.

Mirror one: The physical organization of the learning and teaching space

The future classroom, with advanced technologies and collaborative teams, will be organized in a flexible manner, to meet traditional and innovative organization of learning teams. The physical setting of the classroom will have to accommodate human engineering aspects, peer learning and computer demands. The classroom will have to become a pleasant and flexible place for teachers and students to work. In the future teachers might give instructions also via their computer network, from the teacher's computer to the students' personal computers and vice versa. The classroom will be a decentralized organization with many smaller units (groups or teams), operating simultaneously. This organization of "group of groups" fits group learning and the high-technology environment. The possibility of turning a classroom into a community of peers and computers will allow dynamic presentation of information and products involved in learning projects. The change

in instruction and learning will have to be followed by changes in the design and architecture of other rooms and spaces in the school such as teachers' rooms, laboratories, and libraries.

Mirror two: Learning tasks - using peers and computers as thinking resources

Teachers, alongside their students, and sometimes following them, are learning to use the computer as a tool to develop skills in thinking and reflection. The computer can help to organize and carry out efforts of high level learning and teaching; and to engage students and teachers in challenging tasks. The computer's power lies in the excitement of access to rich and complex bodies of information, in order to construct meaningful knowledge by investigation. Peers working together with computer interweave interpersonal task related learning. They are experiencing a full range of human learning in today world. This learning facilitates the exchange of information with other learning teams and with experts beyond the school walls.

Mirrors Three and four: Teachers as initiators, producers, and communicators of learning.

The roles of the teacher are presently undergoing major changes. Whereas teachers' role were traditionally based on historical definitions " the sage or the stage", they are gradually becoming partners in a community of teachers, and increasingly immersed with students as partners for learning - the "guide on the side" (Hertz-Lazarowitz, 1999). The role of teachers as active initiators and actors of the "show of learning and teaching" will be influenced by the metaphor of production and interpretation (Schonman, 1995). Teachers will become producers of new classroom curricula and programs, where new technology and sophisticated teaching materials are an ongoing part. Multidisciplinary teaching, in addition to mono disciplinary teaching, will become a central part of learning in schools, which in turn will require the establishment and cooperation of multidiscipline teaching teams.

Many of this communication will be via writing. The teacher in the future will need to be a skilled computer user and well versed in complex and varied informational and knowledgeable networks. This teacher will also need to be able to guide students to use technology in an

enlightened way, and not to be consumed by its cognitive shallowness and emptiness. Transforming information into knowledge in a context of moral and ethical dilemmas previously unknown to the teacher could be empowered by working in teams and communities of teachers, and establishing such communities in the classroom. Writing is the powerful force for the classroom of the future, with the use of Telecommunication and intensive peer interaction.

Mirrors five and six: Students' academic and social communication and behaviors

Open electronic communication with the "outside world" will expose teachers and students to peers from other schools and cultures. Through computer-mediated communication on the information highway, every classroom can become a real-time, on-line, information center. Schools will familiarize their students and teachers with the many services of social institutions like research centers, laboratories, banks, newspapers, stock market information, and various resource centers. Students will be able to interact with on-line information and to share and discuss ideas and thoughts with a broad community. The small team within the classroom will be the primary social unit of learning and many bridges will be open to the students. Examples are: in economics classes, to analyze the latest foreign currency data; in citizenship classes, to review last night's public opinion surveys; in sports, to follow the results of the latest games in various states. In these interactive knowledge-seeking contexts, students will master the most significant academic and social skills needed for citizens in the next century: working with people and on-line information in order to cooperate and collaborate with other people for actual learning, analyzing, and decision making.

Insert Figure 1 about here

Writing as a process

In recent years success in elementary school and beyond is evaluated by writing development, thus great emphasis is put on learning environments that fosters writing literacy. Theoretical models of writing guided educational practices. Until the end of the seventies understanding the writing process was based mainly on linear models (Daiute, 1985) those were derived from observation and testing of writing products (Fitzerald, 1987). These models couldn't give an answer about the inner-cognitive process that takes place while writing (Flower & Hayes, 1980). In 1989 Flower & Hayes suggested a multi procedural model including the following procedures: generating, organizing, goal setting, translating, rewriting and editing. Bereiter & Scardamalia (1986) argued that writing is connected to other areas of children's development such as the cognitive level of the children and their moral standards, their social awareness and most importantly their language level. These models of writing were derived from the constructivist approach, which connects development in writing to social and cognitive processes (Vygotsky, 1978). The complexity of the writing process led to deeper understanding of writing, followed by research on writing apprehension and writing blocks of children and adults (Daly & Miller, 1975; Shell, Murphy & Burning, 1989; Zimmerman & Bandura, 1994).

Writing with Computers and using CMC

Computers and CMC are perceived to have a significant potential to advance children's writing and thus are increasingly adopted in the schools of the western world (Bar-Natan & Hertz-Lazarowitz, 1996; Christie, 1998; see also Fabos & young, 1999 for a review of the field). The development of the field can be seen in three waves. The first, in the years between 1980-1987 when CMC projects flourished in the classrooms, with few empirical studies (Levin, Riel, Browe & Boruta,1983). In this point enthusiasm for the potential contribution of computers for teaching and learning was high (Cohen & Miyake, 1986; Daiute, 1984). In the years of 1987-1990, some waning of

initial enthusiasm took place; more demands were voiced to use technology for worthy educational goals (Lenk, 1989). Since then telecommunication in the classroom increased dramatically, but Fabos & Young (1999) challenges the "rhetoric versus reality" in the field saying "...much of the current research is contradictory, inconclusive, and possibly misleading" (pp.217).

While they relate to theoretical issues on writing and the complex role of technology in society, Fabos and Young fail to understand the significance of understanding the classroom as a context for telecommunication. CMC holds a potential to effect educational processes only if it viewed as part of the six mirrors of the classroom. If CMC is an isolated activity/tool with no interconnection to the learning task design, or if the teacher does not change instruction and communication in the classroom, CMC will fail to fully achieve its goals (Almog & Hertz-Lazarowitz, 1999).

Most of the CMC projects focus on writing outcomes and fewer had a research agenda into writing as a process (Bruce & Rubin, 1993; Crook, 1994; Hiltz, 1994). Some programs can save children's writing and rewriting and use it for instruction of the writing process (Bruce & Rubin 1993, using the program "QUILL"). Crook (1994) used interviews with students on the effect of feedback they received from theirs pen pals to improve writing. There is empirical support that computers and e-mail are beneficial for reading and writing over pencil and paper (Crook, 1994; Curtiss & Curtiss, 1995; Bruce & Rubin, 1993; Pope; 1999).

The hidden assumption that like in reading - practice in writing increases engagement and improves writing competencies is naive. Still many studies were based on this line of thought. Miller & Olson (1994) argued that computers will change the way teachers teach, Dauite (1985) emphasized the potential in the word processor to increase writing and composition skills. Bureau (1993), and Becher & Kogan (1992) found that many schools use word processor to improve writing and literacy skills, and that writing with computers versus pencil and paper resulted in fewer errors and more corrections (Grejda, 1992) and better composition (Lam & Pennington, 1995; Breese,

1996). Most of these studies emphasized the new technology and did not study the context of the classroom or the pedagogy of teaching writing. No wonder that the findings are contradictory.

Writing with CMC has the potential to help students on psychological factors related to writing. Anxiety in writing in general (Daly & Miller, 1975) and writing with computer was researched mainly in college students (Mabrito, 1991). Other psychological factors related to writing such as: Writing Self-Efficacy (Shell, Murphy & Burning, 1989), and Self-Regulatory Efficacy for Writing (Zimmerman &Bandura, 1994) were not studied extensively in CMC classrooms. Mabrito, (1991) found that CMC helped students who suffer from writing apprehension. Marom (1996) identified strategies which learners use during the writing process, in CL and comparison classrooms. She found that elementary school students use mostly affective strategies, which include elements of self-encouragement, self-talking and relaxation. CMC was studied in relation to gender. Bresler (1990) found that e-mail is friendly to both genders, and they use this technology equally. In contrast Volman (1997) and Matzko (1996) found that boys have higher level of computer literacy than girls do. CMC was also found to be effective in teaching foreign language at school (Sanaoui & Lapkin, 1992; Singhal, 1998).

In Israel, pilot studies using CMC in Arab and Jewish schools, in Kibbutzim and cities (Bar-Natan, 1996; Bar-Natan & Hertz-Lazarowitz, 1996; 1997), indicated the value of such projects for multicultural/cross national awareness and improving writing. The e-mail exchange included self-presentation, hobbies and activities, learning about the life of the other, writing stories, children's personal affairs, and other topics selected by the writers. In a questionnaire the children reported improvement in writing in general, and using the computer more often. They perceived criticism and feedback from their computer pen pal more positively than criticism from their teacher or peers in their own class.

These small-scale pilot studies enabled us to design the three learning environments for the present study. Using the model of the classroom mirrors, the computer in its limited form becomes

only part of the physical mirror of the classroom similar to other technological aid. With increased complexity the computer can be used by the teacher to changes the design of the learning task to a more inquiry and interactive, and thus changes in teacher and student behavior will follow. The participants in the learning can be encouraged by the teacher to reflect on the writing process while learning. This can be done in either the CL or the CMC contexts. In this study we trained the teacher to understand the conceptual model and to plan according to its guidelines.

Writing in the Cooperative classroom

The CL-ALASH method emphasizes the integrated development of listening, speaking, reading and writing in a peer context. The tasks and activities (mirror 2 of the model) are constructed on division of work between students, individual accountability and integration of group member contribution. The learning tasks call for cooperation in complex levels, but the assessment is both on individual and group outcomes. CL-ALASH is based on BCIRC, Bilingual Cooperative Integrated Reading and Composition (Calderon, Hertz-Lazarowitz & Slavin, 1998), derived from CIRC (Stevens, Madden, Slavin & Farnish, 1987)

In the CL-ALASH method the students are assigned to learning teams. Following a lesson, students work in their teams on a variety of individual and cooperative activities including silent and partner reading, vocabulary enrichment and story comprehension answering Treasure Hunts. The instruction of writing as a process is central to the method. The students learn to brainstorm ideas, to engage in drafts writing, rewriting, editing, revising, and reviewing their writing and their peer writing. For every selected text the students are engaged in many forms of writing; meaningful sentences, predictions, summaries, description of characters/events, mapping, composition and elaborated-creative writing (Hertz-Lazarowitz, in press; Madden, Farnish, Slavin & Stevens, 1993). All of these activities are conducted without using the computer.

Thus CL-ALASH focus on writing within a peer community, and is aimed to overcome writing apprehensions, and help children from early grade to acquire writing strategies. Research in elementary Jewish and Arab schools in Israel show constantly that children improve their writing in comparison to children learning in other methods (Hertz-Lazarowitz, in press; Hertz-Lazarowitz, Lerner & Schaedel, 1996; Hertz-Lazarowitz, Schaedel & Tov-Lee 1997).

Writing in the CL-CMC Classroom

In the elementary schools writing either in CL or CMC holds the potential to effect children psychological emotions related to writing, and their writing strategies (Marom 1997), only if the teacher deals with these issues directly. In more sophisticated classrooms, such as cooperative learning classrooms interaction with peers around their writing is combined with high level learning tasks using the computer as a thinking tool. The mirrors of the social and academic behaviors of the students (mirror 5-6 of the model) are enriched by legitimization and elaboration of cooperation and interaction between students in and out of the classroom. It is assumed that the combination of communication and computer usage encourages the development of high quality writing. Often children review and reflect of their peers writing, give them feedback, which might improve their writing (Bar-Natan & Hertz-Lazarowitz, 1996). In most classrooms that use CMC only some editing and rewriting take place. Teacher reviews the written product of the students, corrects their writing prior to sending their communication. Many of these procedures resemble composition review and evaluation that teachers do in more traditional classrooms, and thus do not extent the potential of the CMC.

CMC was introduced to the CL classroom as an additional but integrated part of their learning. In those classrooms the children did some of the activities with peers outside of their groups. They communicate by CMC with peers in different schools on various topics related to the curricula, but mostly to personal and cultural topics. In this study children from City schools

communicate with children from the Kibbutzim, and Jewish children communicate with Arab children. The writing process in this LE integrated cooperative teamwork, teaching writing as a process with feedback from teachers and peers, and extensive writing with telecommunication.

The sequence of the CL-CMC included; choosing a preferred "electronic pen-pal", brainstorming and discussion of the topic with group mates, writing on the computer and printing a draft, feedback from the teacher, feedback from peers, rewriting and editing, sending the letter via e-mail. Instruction on the writing process was given few times a week. Each week an "e-mail group " was in charge of the organizational aspects. The writing outcomes were collected in the student portfolio.

In sum, the present study aims were the study of writing related psychological factors in three LE that vary in the extent of using technology interaction, peer interaction and the combination of the two. Direct instruction of writing was part of each LE, and all children were engaged in writing couple of hours per week. Writing portfolios served, as examples of children writings but were not the focus of this study (see discussion). The design of this study may contribute some answers to the questions that relate to the impact of these three LE on the writing perceptions of the students. While all agree that instruction of writing, as a process is important, there are rivalry explanations. Some argue writing perceptions and attitudes as well as writing are most effected by the booming technology of the computer. Other argues that peer interaction and cooperation are more crucial then technology. The three learning environments designed for the present study may help to clarify these questions.

Research Methodology

Implementation and Subjects

The schools practiced the different learning environments as part of there on going pedagogy. All schools were at least two years in the programs before the study began. The teachers received in-

service training during the years prior to the study. All teachers had regular meetings of staff development twice a month in the year of the study. The CL-CMC teachers implemented the integrated method for the second year. Observations were conducted two times a year using the six-mirror model instrument (Hertz-Lazarowitz, Baird, Webb & Lazarowitz, 1984, Hertz-Lazarowitz, 1989) to insure that the different methods were implemented in the classrooms (Bar-Natan, 1998).

Subjects

In Israel the educational system is fully segregated by nation. The present research was conducted within twenty 5th and 6th grade classrooms in six schools, three Arabs and three Jewish schools. Five hundred and ninety nine (599) students participated in the study. Of them 210 students were Jews in seven classrooms and 389 were Arabs students in twelve classrooms. Gender was almost balanced; 310 boys and 289 girls

Measurements

A. Students' Perception on Writing in Computers learning environment (SPWC).

This measurement was based on current questionnaires studied in the literature on perception of writing. Since most of those questionnaires address college students, the present study adopted and borrowed items that were suitable to the Israeli context and the age of the children (see the following section). The SPWC is based on items from the Writing Apprehension (Daly & Miller, 1975), Writing Self-Efficacy (Shell, Murphy & Burning, 1989), and Self-Regulatory Efficacy for Writing (Zimmerman & Bandura, 1994). Two measures were developed for this study, Writing with Computer, and Computer Network (CMC). A factor analysis yielded five factors as sub-scales, which explained 49.8% of the variance.

1.Writing apprehension: Eight items adopted from Writing Apprehension Test (Daly & Miller, 1975), four positives and four negatives consist this scale. For examples: "I avoid writing", "I enjoy writing". Alpha was .83; a high score means less writing apprehension.

2. Writing self-efficacy: Three items adopted from the Writing Self-Efficacy (Shell, Murphy & Burning, 1989). For example: "I write a letter to a friend or a family member", " I author a short fiction story". Alpha was .77.

3. Self-regulatory efficacy for writing: Nine items adopted from the Self-Regulatory Efficacy for writing (Zimmerman & Bandura, 1994). For example: "When I edit a complex paper, I can find and correct all my grammatical errors", "I can start writing with no difficulty". Alpha was .90.

The authors composed two additional scales.

4. Writing with computers: Four items, three positives and one negative. For example "I prefer to write with the computer", "It's hard to write fluently with the computers". Alpha was .79

5. Computer network (CMC): Seven items, six positives and one negative. For example "Using the computer-network I can write about things that I can't speak about with my friends", "While writing in the computer-network people react only to my writing". Alpha was .86

Expert teachers and researchers from the University of Haifa selected the questionnaire's items to be included. The measures were first examined in a pilot study (Bar-Natan, 1998). The SPWC was translated from Hebrew to Arabic and vice versa. The reliability of the translations was 94%. Alpha coefficients for the sub-scales in the pilot study were similar to the range of the present study. Based on the pilot study (n= 400) we finalized the SPWC. The overall Alpha Coefficient of the SPWC was high (.90). (See Table 1 in the Appendix)

B. *Teachers' assessment.* Each teacher was asked to assess all of the students in the class on five items: Ability to Self-Correct Writing, Progress in Writing, Planning of Writing, Writing Poems and Stories and Writing with Computer. The range was from 1 (low) to 5 (high). Teachers also reported the final grade in Language Art for each student (10-100).

C. *Writing Portfolios.* In the CL- CMC classrooms samples of portfolios were evaluated using measures for structure and content (Peled, 1996; Hertz-Lazarowitz et al, 1997). This part is described in details in Bar-Natan (1998).

Procedure

Data from the students was collected twice in the school year 1996-1997. In September, (pretest) and in June (post-test). Data from the teachers was collected only in June. Visits and observations to the schools confirmed that each learning environments was implemented as designed (Bar-Natan, 1998). Two graduate students one Jewish and one Arab from the Faculty of Education, at the University of Haifa administrated the questionnaires to whole classrooms. Each student in the study answered the questionnaire in his/her native language- Arabic or Hebrew.

Results

The SPWC

Multivariate Repeated Measures analysis was conducted on student data. The dependent variables were the five factors, and the independent variables were the learning environment (3), nation/religion (2) gender (2) and time (2).

Multivariable MANOVA analysis was conducted on the teacher data, for the above independent variables. There were significant differences for the main factors of Time on all measures, (F (df 1,598) values range 65.9 to 95.7, $p<.00$); the Learning Environment on all measures, (F (df 2,597) values range 15.9 to 43.6, $p<.00$); and for Gender on two measures: Writing Apprehension, (F (df 1,598) = 7.33, $p<.00$) and Writing Self-Efficacy ($F = 4.58$, $p<.00$). No significant differences were found between Jews and Arabs (nation/ religion factor). The two ways or three ways interaction with the learning environment were addressing the main research questions.

The learning environments

As predicted the CL-CMC learning environment created the larger gains with time in scores for the students. No significant differences were found in the pre test measures. Tukey test showed that CL-CMC was significantly higher in the post-test, compared to the other two learning environments, which were not significantly different. The gains in the school year for CL-CMC were 0.7 to 1.00 on a five scores scale. In the CL only, the scores decreased slightly. In these classrooms students did not work with computers, and their answer to these scales were hypothetical. The data shows that CL did not produce as hypothesized gains in writing related measures, it might be due to the ceiling effect as student had high scores in the pretest (table 2). In the CMC no gains were found in all of measures. Students in these two LE were stable in the SPWC, while most changes took place in the CL-CMC.

Insert Table 1 & Figure 2 about here

Jews and Arabs

No main effects were found related to nation/religion. Two-way interaction of the learning environment by nation/religion showed significant gains differences in having less Writing Apprehension (F (df 2, 598) = 11.53, $p<.05$) and more Writing Self-Efficacy ($F=3.38$, $p<.03$). Jews and Arabs were the highest in CL-CMC, but they maintain the largest gap between them. Arabs decreased scores with time in the other two LE. Self-Regulatory Efficacy for Writing was significant for the three-way interaction: time, nation/religion, and learning environment (F (df 2,598) = 8.96, $p<.00$). Indicating that the Jewish students increased their self-regulation evaluation significantly more then the Arabs student with time in the CL-CMC learning environment. Overall CL-CMC advanced Arabs the most, but did not equalize then to the Jewish group. This finding is partially explained by the fact that overall Arabs evaluated themselves higher then Jews in the pretest.

Insert Table 2 & Figure 3 about here

Gender

No main effect, neither two-way interaction was significant for gender Three way interactions were significant in two scales. The boys gained the most in writing self efficacy with time (F (df 1,598) = 5.21 p<. 00) and in self regulatory efficacy for writing (F =3.86 p<. 02) in CL –CMC, but in the CMC the girls gained the most with time on these measures.

Insert Table 3 & Figure 4 about here

The teachers' evaluations

Pearson correlation were conducted between students' self evaluation on the SPWC and teachers' evaluation on the five measures, the correlation range was .35 - .57. The MANOVA analysis showed a main effect for the learning environment on all measures except writing with computers (see Table 4). Overall teacher evaluated their students in the CL-CMC and CMC similar and significant higher than their CL students who didn't use the computers for writing at school (this scale was omitted from teachers' evaluation in CL). Overall teachers evaluated their students higher when they were engaged with computer. Teachers' evaluation was less differentiated compared to students' self-report.

Insert Table 4 & Figure 5 about hear

Discussion

The impact of CL-CMC on SPWC

CL-CMC produces remarkably gains in the SPWC for the students, thus the richest LE enriched most its participants. The important finding is that CL-CMC equalized and enriched significantly Arabs and girls- groups that are usually gaining less. Thus the notion of "the rich is getting richer" was shattered in this study. The ability of the teachers to develop a learning environment, which integrates quality pedagogy for teaching/learning writing with the CMC technology proved to be powerful on the measures we studied. It was however unexpected to find that the other two LE were less promising. One explanation for this finding is that in the CL classrooms the students evaluated them selves higher in the pretest and since they did not experience working with the CMC, they were deprived from the chance to develop their self-evaluation on the computer related measures, and their writing in general. This study did not evaluate writing products in the three LE, and future study should look into perceptions and attitudes as well as to writing products.

>From earlier studies in Israel and the USA comparing CL and not CL classrooms we know that children scores in Language Arts in general and writing in particular are higher (Calderon, Hertz-Lazarowitz & Slavin, 1998; Hertz-Lazarowitz, 1999; Slavin & Madden, in press). The present study suggested that quality implementation of cooperative learning with CMC based on the contextual model, can be a powerful pedagogy for instruction of writing as a process.

The present study deliberately studied perceptions and attitudes related to writing because psychological factors might affect the willingness engagement and enjoyment of students in writing with computer. We know very little about the effect of the above on the process of writing with the use of computer technology and CMC. Also the impact of different learning environment on students writing strategies is not studied enough (Marom, 1996). Often the assumption that technology will affect students' perceptions about writing is expressed but not directly studied (Berg & Collins, 1998; Christie, 1998; Ezer, Mor & Meirav, 1996; Solomon, 1996).

Observations and reflections about writing in different LE are essential in all age level. Gruber (1995) recommendations based on a study within a graduate seminar were to develop a pedagogy that allows for conflict resolution, and one that critiques conformity and homogeneity in the classroom-those are part of the CL methods. Moreover all her suggestions how to improve writing are applicable to elementary school children as well; careful judgment of the writing material (Hertz-Lazarowitz et & Schaedel 1998) and feedback on the writing process (Kerlitz-Nisim 1998).

Students' writings' examples

A sample of students' portfolios in CL-CMC were carefully analyzed and evaluated (Bar-Natan, 1998), with no comparison in the other two LE, as an indication about the high quality of the writing. The following inserts from the portfolios illustrate the level of writing of the children and its quality in content and form. Nathaniel a Jewish 5th grader from a kibbutz near Acre writes to his Arab pen pal: "I live in kibbutz G. The kibbutz was established before the State of Israel...The kibbutz is a special place where people live together, work together and give the money they earn to the kibbutz. In exchange they receive food, housing and other things that they need...When I finish my school day, I am going to eat in the kibbutz dining hall and then I go to the children home for my activities. Only in the evening I go to my parents' home... I think the most special thing in the kibbutz is the life of cooperation. Once there was more cooperation as the children also slept in the children home, but it was changed few years ago because the parents missed the children and wanted them to be with the family. Now all my friends and me are sleeping at home. I heard many stories about the beginning of the kibbutz from my grandparents; they were living in tents and worked very hard to build our kibbutz... I tried to explain you a little about the kibbutz and I want that you'll tell me about your life in the city. I am looking forward to receive your letter".

Sammy, an Arab 6th grader from Acre (a mixed Arab-Jewish city) writes: Our school is near the sea of Acre. It is a very big school with 1200 students from Acre and from the Arab villages in the Galilee close to Acre. I like my school and recess time when I play soccer. In school I like computers because we write letters and we do lots of things. I like the Arabic lessons and Math and English...My Dad says I have to be a good student. I have a computer at home and I am beginning to write on the computer and play games.... I want to tell you about Acre, I moved there when I was five years old, and I love Acre. I think that old Acre is beautiful, and there are also beautiful neighborhoods in the new city. I love to go to the beach...In the old city there is a small port where the fishermen come with their fishing boats and sell fish. I love to go and see the fishermen and the many restaurants by the sea. I think you should come and visit Acre." These two children live 20 miles apart, but Sammy was not in the kibbutz, and Nathaniel never visited nor communicated with an Arab peer.

It is apparent that the personal and social interaction via high-level writing increases children feelings of self - efficacy, self- regulation and liking for writing with the CMC, it also reduces anxiety and apprehension. Bresler (1990), notion that interpersonal communication allowed students to find a place to express feeling which do not usually have a place in school is another factor to explain the present findings. The contribution of the CL-CMC to the affective domains of children's' writing is prominent in this study. The equalizing factor of the CL-CMC on gender and religion needs more research. Prior studies showed consistently that CL increases gains of Arabs and of girls in writing. The present research design indicated the power of CL- CMC as an integrated method to make even greater differences. Teachers also see the potential of such LE for writing development, and similar findings were reported by Pan & Zbikowski (1997) and Mills (1999), in their study on teachers. Many writers share the acknowledgement of the potential of technology and cooperation; alongside the call to support teachers in quality implementation of such learning environments.

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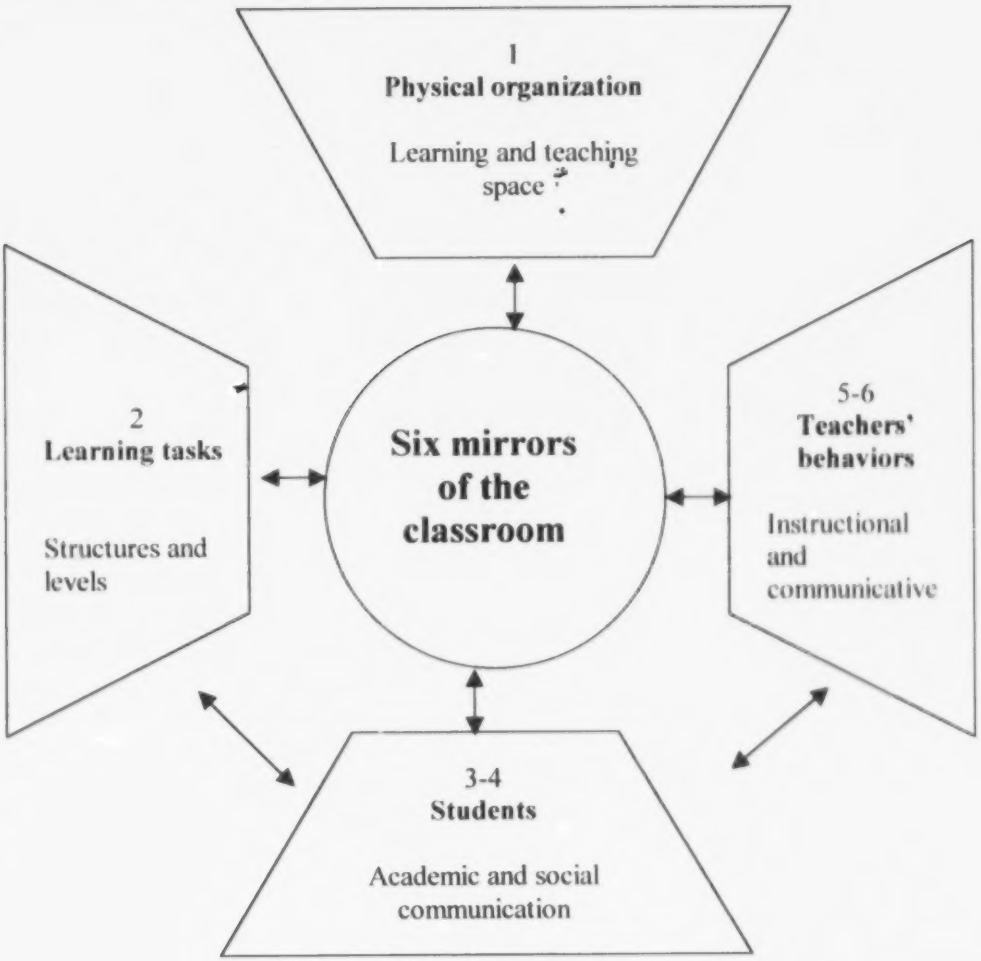
Figure 1: The Six Mirror



Six mirrors of the learning – teaching environment

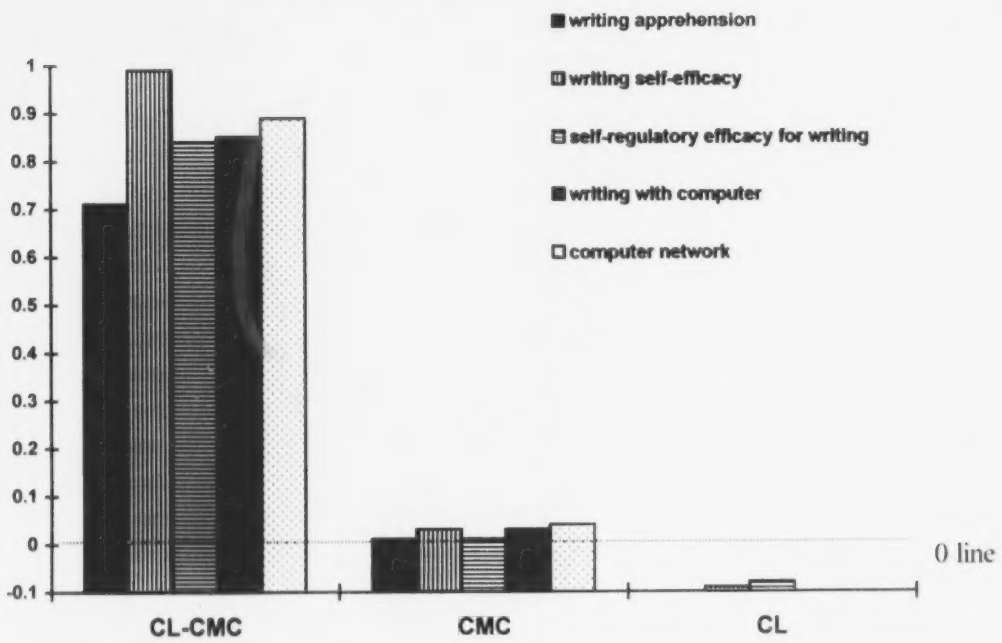
Table no. 1: Students Perceptions on Writing (SPWC)

(Means and F values)

Measure		CL - CMC N=369	CMC N=99	CL N=114	F* (p)
Writing Apprehension	Pre	3.97	3.92	4.02	171.0
	Post	4.68	3.93	3.89	(.00)
Writing Self-Efficacy	Pre	3.64	3.93	3.75	134.6
	Post	4.63	3.96	3.66	(.00)
Self-Regulatory Efficacy for Writing	Pre	3.73	3.98	3.85	177.1
	Post	4.57	3.99	3.77	(.00)
Writing with Computers	Pre	3.83	4.04	3.95	117.3
	Post	4.68	4.07	3.85	(.00)
Computer Network	Pre	3.74	4.00	3.85	137.4
	Post	4.63	4.04	3.74	(.00)

(d.f. = 2, 598) : * p< .05

Figure 2: Students gains Score in Writing (SPWC)



CL- Cooperative Learning

CMC – Computer Mediated Communication

Figure 3: Jews and Arabs, Gains Scores in Writing (SPWC)

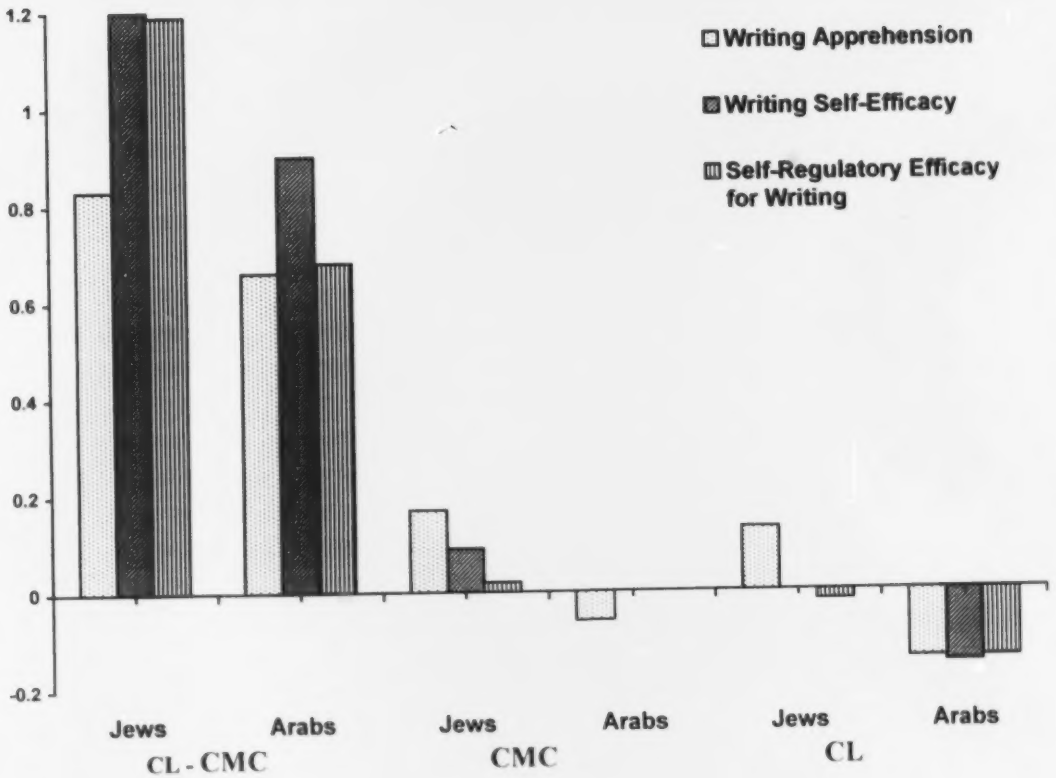


Table 2: Jews and Arabs, Score in Writing (SPWC) (Means and F values)

Measure			CL - CMC	CMC	CL	F* (p)
Writing Apprehension	Pre	Arabs	4.03	3.94	3.89	11.35 (.00)
	Post		4.69	3.88	3.75	
	Pre	Jews	3.82	3.88	4.18	
	Post		4.65	4.05	4.05	
Writing Self-Efficacy	Pre	Arabs	3.76	3.92	3.79	3.38 (.03)
	Post		4.66	3.92	3.64	
	Pre	Jews	3.35	3.94	3.69	
	Post		4.55	4.03	3.69	
Self-Regulatory Efficacy for Writing	Pre	Arabs	3.86	4.01	3.79	7.09 (.00)
	Post		4.54	4.01	3.65	
	Pre	Jews	3.43	3.90	3.94	
	Post		4.62	3.92	3.92	

(d.f. = 2, 598); * p< .05

Figure 4: Boys and Girls, Gains Scores in Writing (SPWC)

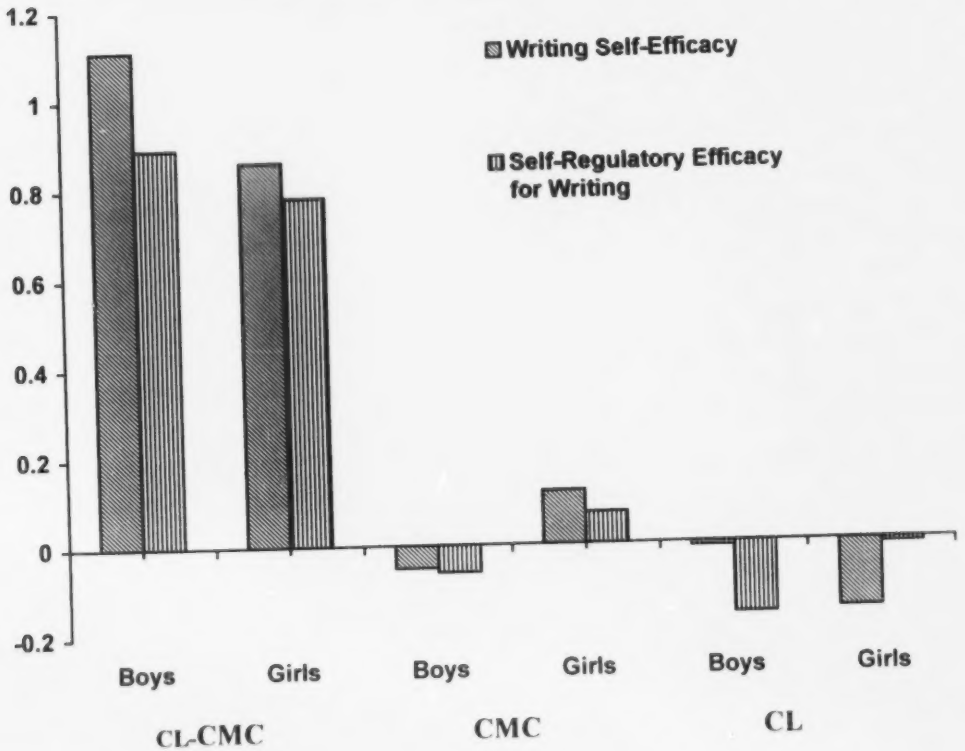


Table 3: Boys and Girls, Scores in Writing (SPWC) (Means and F values)

Measure			CL - CMC	CMC	CL	F* (p)
Writing Self-Efficacy	Pre	Boys	3.52	3.85	3.72	5.21 (.00)
	Post		4.63	3.80	3.71	
	Pre	Girls	3.76	4.01	3.77	
	Post		4.62	4.13	3.62	
Self-Regulatory Efficacy for Writing	Pre	Boys	3.68	3.98	3.90	3.86 (.02)
	Post		4.57	3.92	3.74	
	Pre	Girls	3.78	3.98	3.81	
	Post		4.56	4.05	3.80	

(d.f. = 2, 598); * p< .05

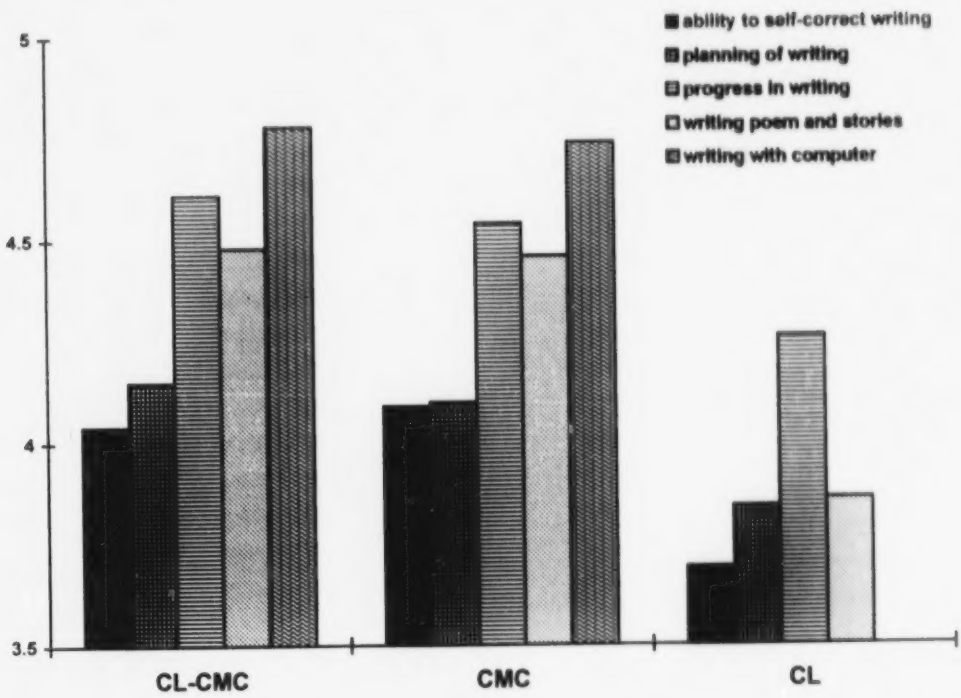
Table 4:Teachers' Evaluation of Students Writing

Means, SD, and F values)

Sub-scale	CL-CMC N=369	CMC N=99	CL N=114	F*
Ability to self-correct writing	4.04 (.64)	4.09 (.64)	3.69 (.59)	15.17 (.00)
Planning of writing	4/15 (.65)	4.10 (.61)	3.84 (.59)	11.17 (.00)
Progress in writing	4.61 (.58)	4.54 (.61)	4.26 (.62)	15.34 (.00)
Writing with computer	4.78 (.46)	4.74 (.51)	No Answer	n.s.
Writing poems and stories	4.48 (.69)	4.46 (.69)	3.86 (.68)	34.54 (.00)
Final grade in Language Art	86.48 (10.05)	85.76 (10.56)	79.66 (11.12)	17.61 (.00)

d.f.= 2, 580; *p< .05

Figure 5: Teachers' Evaluation of Students Writing



Appendix

Table 1: Alpha coefficients for the sub-scale in the questionnaire

Sub-scale	Original measures	No. of items	This study	No. of items
Writing Apprehension	.94	26	.83	8
Writing Self-Efficacy	.92	20	.77	3
Self-Regulatory Efficacy for Writing	.91	25	.90	9
Writing with Computers			.79	4
Computer Network			.84	7